Nitrogen-doped graphene-shell-encapsulated platinum nanocatalyst supported by SWCNTs with high performance and high durability for fuel cell

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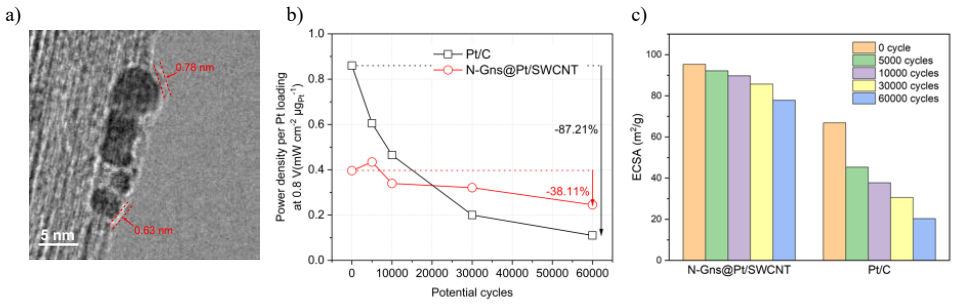
High cost and susceptibility to corrosion of platinum-based catalysts, widely used in polymer electrolyte membrane fuel cells (PEFCs), remain major barriers to their development. The development of electrocatalysts featuring high efficiency, enhanced durability of Pt nanoparticles and more durable carbon support nanomaterials represents the trend in advancing PEMFCs device. Here, we report a nitrogen-doped graphene-shells-encapsulated platinum nanocatalysts supported by SWCNTs (N-Gns@Pt/SWCNT), featuring a core-shell structure that protects Pt nanoparticles.

DMF 6 mL, ethylene glycol 4 mL, and $H_2PtCl_6 \cdot 6H_2O$ 8wt% 100 mg were mixed and stirred, and added to the SWCNT treated by SP process.[1] The mixture dispersed by ultrasonication for 15 min was reacted in a Teflon lined autoclave at 170 °C for 8 h to synthesis the N-Gns@Pt/SWCNT.[2] N-Gns@Pt/SWCNT demonstrates remarkable durability, with an ECSA retention exceeds 80% after 60,000 ADT cycles and power density retention exceeds 60% at 0.8 V. The high chemically-durable of SWCNTs further contributes to stable performance and minimizes corrosion even under rigorous high-voltage triangular wave. At triangular wave, power density retention of N-Gns@Pt/SWCNT is more than 9 times that of commercial Pt/C. This work achieved higher durability by combining nitrogen-doped graphene with SWCNTs, offering insights for designing fuel cell catalysts with longer lifespans and lower cost. This work also provides a valuable reference for the application of SWCNTs for PEFCs.



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